MODIFICATION OF POLYETHERSULFONE INCORPORATED WITH POLYVINYLPYRROLIDONE-IODINE VIA PHASE INVERSION AND ULTRAVIOLET PHOTO-GRAFTING FOR ANTIBACTERIAL APPLICATIONS

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ABSTRACT

Incorporation of antibacterial agents into polymeric membrane is one the widely studied surface modification. Polyethersulfone (PES) membrane incorporated with polyvinylpyrrolidone-iodine (PVP-I) were prepared using phase inversion and UV induced photo-grafting techniques. The modified PES-PVP-I membranes were characterized in term of gravimetric analysis, FT-IR analysis, FESEM analysis, water flux, contact angle, porosity measurement and antibacterial effect against *Escherichia coli (E.coli)* and *Bacillus subtilis (B.subtilis).* The high water flux indicated by PES-4 and PES-7 show an improvement by the addition of PVP-I by 52 % to 62% higher compared to original PES membrane. For the UV method, the water flux decline with the increasing of irradiation time by 31 to 35% compared to the commercial original PES membrane. PES-PVP-I membranes with 10 wt% of iodine concentration developed by phase inversion and UV photo-grafting show strong antibacterial properties using halo zone test. The highest inhibition zone of PES-PVP-I membranes produced using UV photo-grafting and phase inversions against *E.coli* were 2.30cm^2 and 1.88cm^2 and against *B.subtilis* were 0.41cm^2 and 0.48cm^2. The results indicated that both methods used were favorable towards antibacterial properties with high inhibition zone and as well as in the improvement in water flux, contact angle and porosity of PES-PVP-I membranes compared to the original PES. This study shows that PES-PVP-I membrane suitable to be used in wide variety of antibacterial applications.

ABSTRAK

Kemasukan antibakteria ke dalam membran polimer adalah modifikasi permukaan yang luas dikaji. Pengubahsuaian permukaan polyethersulfone (PES) membran menggunakan polyvinylpyrrolidone-iodine (PVP-I) disediakan dengan menggunakan penukaran fasa dan melalui sinaran ultraviolet (UV) photografting teknik. PES-PVP-I membran yang diubahsuai diuji dari segi gravimetrik analisis, FT-IR analisis, FESEM analisis, ketelapan air, keseimbangan isi air, keporosan dan keberkesanan antibakeria dinilai terhadap *Escherichia coli (E.coli)* dan *Bacillus subtilis (B.subtilis).* Ketelapan air yang tinggi ditunjukkan oleh PES-4 dan PES-7 menunjukkan peningkatan dengan penambahan PVP-I sebanyak 52% hingga 62% lebih tinggi daripada PES membran asal. Dengan kaedah UV, ketelapan air menurun dengan peningkatan masa sinaran sebanyak 31% hingga 35% berkurangan berbanding PES membran asal. PES-PVP-I membran dengan kepekatan 10 wt% iodin dibentuk menggunakan fasa penukaran dan sinaran UV menunjukkan ciri-ciri antibakteria yang tinggi. Zon perencatan yang tertinggi dihasilkan melalui sinaran UV dan fasa penukaran terhadap *E.coli* adalah 2.30cm^2 dan 1.88cm^2 dan *B.subtilis* adalah 0.41cm^{-1} dan 0.48cm^{-1}. Kedua-dua teknik menunjukkan ciri-ciri antibakteria menggalakkan dengan zon perencatan yang tinggi dan juga pengubahan PES-PVP-I membran dari segi ketelapan air, keseimbangan air dan keporosan berbanding PES asal. Ini menunjukkan ia sesuai digunakan untuk pelbagai aplikasi antibakteria.